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A Comparative Study of the Speech Developments of Japanese and American English in Childhood (2)*

—The Aquisition of Speech—

Sei NAKAZIMA

SUMMARY

We recorded the voices of six Japanese, four American infants, in Japan, and one American infant, in the U.S.A., from birth to fourteen months, and compared 1) articulation developments and 2) speech communication developments of the three groups.

1) We observed differences in intonation from about one year and differences in articulation from about one year and two months between Japanese and Americans, both in Japan and in the U.S.A., influenced by their parents' language system. 2) We observed almost the same tendency of speech communication development among the three groups. At one and two months their response in voice to voice stimuli developed a little. From about two months their phonation and articulation developed but their speech communication kept the same developmental level as before. Their phonation and articulation developed at first in the domain of non-communication utterances. Then they used these voices in expressing their emotions or in responding to voice stimuli. From about nine months, at first their response in simple voices to voices and then imitation of their parents' voices developed, and their evocation with simple voices developed a little. From about one year they began to use conventional words. From about one year they used their meaningless voices in talking and responding to others actively, at first with simple or repetitive-babbling-like voices and then with long complex voices in conversation-like intonation. From about one year and two months they began to use some conventional words in conversation situation correctly. But sometimes they uttered same voices as the words when they were playing alone and they used them in uncorrect situations.

I. INTRODUCTION

In order to make clear the developmental process of speech in childhood, we recorded voices of six Japanese and four American children who were living in Kyoto, Japan, by a tape recorder, analyzed them by the Soundspectrograph, compared their developmental processes, and divided the prelinguistic period, i.e. from birth to about one year, into several stages mainly from the viewpoint of the develop-

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ment of articulation mechanism (3). The developmental process of the American children's speech was influenced not only by their parent's language system but also by their Japanese maid's and by their Japanese friends' language system (3).

Last academic year, 1964-65, I was in the Department of Psychology, the University of Illinois, and recorded four American children's voices by a tape recorder, i.e. a male from six months to one year and three months, a female from one year and four months to two years and one month, a male from two years and six months to three years and four months, and a female from three years and six months to four years and two months.

In this article, we are going to 1) compare the developmental process of the articulation mechanism of the youngest of American children who were living in the U.S.A. with those of Japanese and American children who were living in Japan, and 2) make clear the developmental process of the speech acquisition of the children and the influences of environmental factors, especially of the language system of their parents, upon the process.

II. PROCEDURES

Subjects (Ss) were three female and three male Japanese and two female, two male American who were living in Kyoto, Japan, and one male American who was living in the U.S.A., shown in Table 1. Their parents' socioeconomic statuses were almost the same, e.g. university professors or something like. We recorded voices of each subject in its favorite room where it usually spent its playing time by a tape recorder and described the situations in which it uttered voices and behaved. We recorded voices when they were with mother or father and

Table 1. Subjects and Recording Condition*

Nationality	Place where S's voice was recorded	Subjects (Sex)	Beginning of Recording by Tape Recorder	One Recording per
Japanese	Kyoto, Japan	E.T. (F)	28 day (0;0,28)	1 Wk.
		Y.S. (F)	2 Mos. (0;2)	2 Wks.
		Y.N. (F)	1 Mo. (0;1)	2 Wks.
		H.K. (M)	1 Mo. (0;1)	2 Wks.
		T.T. (M)	7 Mos. (0;7)	2 Wks.
		T.Y. (M)	1 Mo. (0;1)	2 Wks.
American	Kyoto, Japan	G.M. (F)	3 Mos. (0;3)	2 Wks.
		F.P. (F)	6 Mos. (0;6)	2 Wks.
		E.D. (M)	7 Mos. (0;7)	2 Wks.
		C.W. (M)	6 Mos. (0;6)	2 Wks.
American	Champaign, Illinois, U.S.A.	C.C. (M)	6 Mos. (0;6)	2 Wks.

* We could not record regularly, because of S's or recorder's sickness, etc..

when they were alone, i.e. we were behind a door or something like that. Each recording took about half an hour. We used two kinds of tape recorder: TEAC (TD 102, AR 11) for Ss who were living in Japan and SONY EM-1 for S who was living in the U.S.A.. The former's overall recording and reproducing characteristic was from 40 cps to 15000 cps ± 3 db, the latter's from 100 cps to 7000 cps ± 5 db, speed 7 1/2 inch/second. We analyzed these voices by the Soundspectrograph, wide band, and recorded their overall envelopes by the Amplitude Display Unit.

III. RESULTS AND DISCUSSIONS

We are going to describe and discuss these eleven Ss' data. But to save space, we select two Ss, T.Y., a male Japanese, and C.C., a male American, and exhibit their sonagrams, in Fig. 3 and 4, and their case histories in Table 4, 5.

1. The comparison between the developmental process of the articulation mechanism of C.C., male American, living in the U.S.A., and those of Japanese and Americans, living in Japan.

On our last paper, untill about ten months, the Ss, both Japanese and Americans, articulated phonetically most of the sounds which belonged to both Japanese and American English phoneme system, except some round vowels, some semi-vowels, and some fricatives. But even at one year the Ss' articulation was not correct both in speaking imitatively and spontaneously, though they pronounced the intonation of the words fairly correctly (3).

In some cases of Japanese, Dr. Murai found that vowel-like voices developed from the middle to the front on one side and from the middle to the back on the other side, i.e. from the relaxed to the tense, and that consonant-like voices developed at first from those articulated by the back of the tongue, next from those by the lips to those by the front of the tongue then to those by the back of the tongue again (1). On our last paper, we obtained the same tendency in both cases of Japanese and Americans (3).

As shown in Fig. 4 and Table 5, C.C. showed the same tendency of vowel-like voice development and of consonant-like development as that found by Dr. Murai.

Sometimes C.C. uttered [u]-like voices. As stated, voices described in Table 4, 5 and in Fig. 3, 4 were not the same as those described by phonetic symbols but only roughly similar to them. These [u]-like voices were something between middle vowels and back vowels with relaxed articulation organs. They were not differentiated to be [u], a round back vowel. Therefore, when his articulation organs became more tense, these [u]-like voices seemed to become [u]-like voices, flat back vowels. /u/, one of five Japanese vowels, is phonetically described as [u]. Even at about one year, Americans, in Japan, articulated [u]-like voices instead of [u] or [u] (3). Untill about one year we did not observe any meaningful dif-

ferences among articulations of Japanese, Americans in Japan, and American in the U.S.A..

At eleven months T.Y. uttered [hahaha]-like voices in a conversation situation. C.C., at thirteen months, uttered [h̃h̃h̃]-like voices in a conversation situation, too. C.C. uttered these voices with the same rising intonation as in a conventional way. [hahaha] is one kind of onomatopoetic laughing sounds and is uttered in monotone. Once T.Y. imitated mother's [hahaha] and then he uttered these sounds in monotone. Though Japanese do not use [hahaha] in a conversation situation, we can say he pronounced their intonation correctly. On our last paper the difference in intonation between Japanese and Americans, influenced by parents' system, was observed from about one year, too (3).

At twelve months T.Y. uttered [ɕ]-like voices. Imitating parents' "shoes", C.C. uttered a [ɕ]-like voice at thirteen months and [ʃ]-like voices at fourteen months. [ɕ] is articulated with flat lips, [ʃ] with round protruded lips. Their sonagrams are different, Fig. 3.50, 3.51, 4.50, 4.55, and (2). To pronounce [ʃ] requires more differentiated articulation organs than to pronounce [ɕ]. In Japanese phoneme system we do not have /ʃ/. This is the first evidence of articulation differences influenced by parents' language system. On our last article, a female Japanese uttered [ʃ]-like voices at ten months imitating mother's [ʃ]. But as we stated, when an infant articulates a [ɕ]-like voice with an effort it may turn into a [ʃ]-like voice by chance (3). In T.Y.'s and C.C.'s cases we observed the articulation difference rather constantly. We think this kind of articulation differences appear from about ten months rather by chance, from about fourteen months rather constantly.

We will describe further developmental process of phonemicization on our next paper.

2. The Developmental Process of the Acquisition of Speech.

In order to make clear the developmental process of the acquisition of speech in childhood, we would like to classify utterances as follows;

Utterances

I. Non-crying Utterances

1) Communication Utterances: Utterances which are uttered in communication situations.

1. Voice Responses to Voices: Responses in voice to other person's voice stimuli.

1) Using words: Responses in voice to other's voice stimuli using words in a conventional way, excluding imitation.

2) Imitation: Imitation responses in voice to other's voice stimuli, including meaningless voices and conventional words.

3) Others: Other responses in meaningless voice to other's voice stimuli.

2. Spontaneous Utterances: Spontaneous uses of voice to other persons.

- 1) Naming: To utter the name of objects or situations using words in a conventional way to other persons spontaneously.
 - 2) Evocation: To evoke other persons with voice, including meaningless voices and conventional words.
 - 3) Other: Other spontaneous uses of meaningless voice to other persons, e.g. asking food etc..
- II) Non-communication Utterances: Utterances which are uttered in non-communication situations, i.e. without any direct relations from and to other persons.
- II. Crying.

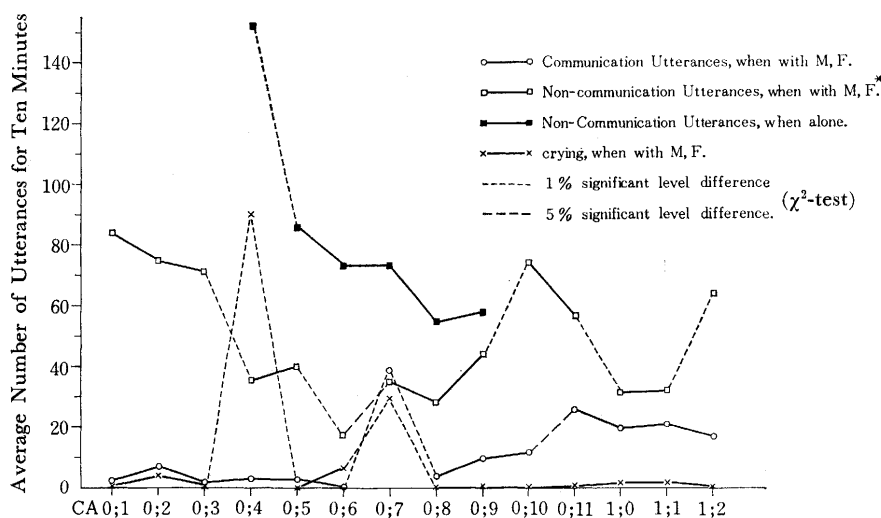


Fig. 1. The Developmental Process of Communication Utterances of T.Y..

M: mother F: father Refer to Table 2.

* While in the crib at 0;1, 0;2, and after drinking juice, taking a bath at 0;3.

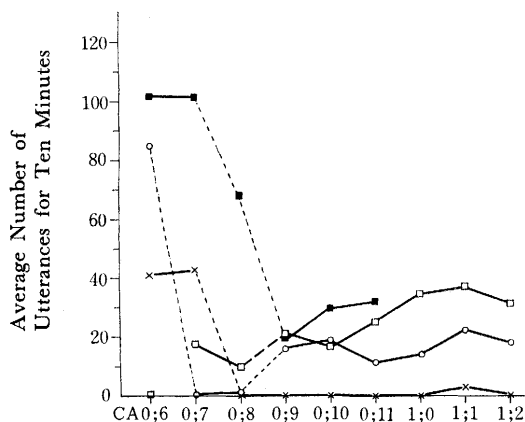


Fig. 2. The Developmental Process of Communication Utterances of C.C..
Refer to Table 3.

We recorded the Ss' voices in various situations; in one situation for about ten minutes. We counted the number of utterances without any considerations about the duration of utterances. We show the average number of utterances for ten minutes in various situations according to the classification in Table 2, 3, and Fig. 1, 2. Ss: T.Y. and C.C.

As stated, on our last paper (3) we divided the prelinguistic period, i.e. from birth to about one year, into several stages mainly from the viewpoint of the development of articulation mechanism. We would like to describe the process of the acquisition of speech along the stages.

1st Stage: From birth to the time of the beginning of the non-crying utterance, i.e. from birth to about one month. The voices produced by the Ss were crying. They cried when they were in a state of discomfort. When they cried their mother came to them to take away the causes of their discomfort. When their needs were satisfied they stopped crying. We supposed that the schema*² of evocation, i.e. the schema of using voices to evoke other persons, developed by crying from this stage on (3).

2nd Stage: The beginning of the phonation of the non-crying utterance; at about one month. The Ss began to produce non-crying calm voices mainly with the vibration of the vocal cords (3). We think that the schema*² of phonation, i.e. the schema of producing non-crying voices spontaneously mainly by the vocal chords, is one kind of hereditary organic actions and it develops from this stage on. Even at this stage the Ss responded in voice to voice stimuli. The Ss responded only when they were in a state of comfort and in a face to face situation with someone talking to them, but not always. In this situation they not only responded in voice to voice but also uttered non-crying voices. We did not find any differences between the voices they responded to voice and those they uttered spontaneously. We are not sure whether they responded in voice to voice actively or they were stimulated to utter these voices by someone's voice. We suppose the latter may be true. Sometimes they continued to utter after responded in voice. We suppose that the schema*² of response in voice may be one kind of hereditary organic reactions, but not differentiated at this stage.

At this stage the Ss uttered non-communication voices actively. In some cases they uttered this kind of voices more frequently when they were alone than when with someone and in other cases they uttered more frequently when with someone than alone. T.Y. uttered more frequently when in the crib with mother or father than when in father's arms. We would like to say that they uttered non-communication voices more frequently when they were in the situation, in which they had spent longer part of their time and had become more familiar, than in any other situations.

3rd Stage: The development of articulation; about two to five months.

*2 We use the term "schema" according to J. Piaget's definition (4), (5).

Gradually the Ss' articulation mechanism developed through this stage (3). Of course, articulation, the modification of phonated voices by articulation organs, can not be separated from phonation. As a matter of fact, the Ss began to modify their voices a couple of weeks after they began to phonate. Therefore from this stage on we would like to consider phonation and articulation to be one schema as a whole. We think the schema of phonation and articulation develops from this stage on.

At two months the Ss' voice responses to voice seemed to become more stable. But after three months, the Ss seemed to respond in voice to voice less frequently than at two months, though we did not get any significant differences between the number of this kind of responses at two months and that at three months. Why this kind of responses did not develop from three months on? We would like to say that the most important characteristic of speech development at this stage is the development of articulation. The Ss seemed to be practicing their articulation organs intensively, based on the maturation of their articulation organs, with little considerations how to use their voices in communication situations. They not only uttered voices in various ways, e.g. changing pitch, changing articulation, changing the duration of one phonation, etc., but also repeated opening and closing their mouth or putting their tongue in and out without utterance.

Why did not they use their voices in communication situation? Speech is considered to be one of the most important means of communication. There is no theory which can explain this kind of autistic feature of the speech at the so-called babbling period. We are not interested in defining the period of babbling. We would like to say that the non-crying utterance at this stage, especially from three months, can be considered as one of Piaget's so-called secondary circular reactions (4), (5). According to Piaget, between three and six months, usually from about four and a half months, is the third sensorimotor stage: the stage of the secondary circular reactions. The circular reaction which affects infant's body itself is given the name primary circular reaction, whereas thenceforward it is applied to external objects. This behavior affecting objects is called the secondary circular reaction, although these are not yet by any means conceived as substances by the infant. The secondary circular reaction occurs in an early form in the structures characteristic of simple habits. These are independent items of behavior, which are repeated as wholes without any pre-established goal and affected by chance circumstances occurring during the process (5).

Almost always the Ss repeated uttering non-crying voices without any communication functions. But this kind of autistic characteristic, i.e. without any pre-established goal, is rather common to various behavior patterns at this age level, as Piaget stated. We suppose that sounds produced by infants correspond to external objects which are affected by the secondary circular reactions. Infants produce sounds and the sounds stimulate infants to produce sounds. At the stage

of the secondary circular reactions this kind of feed back system is more functioning than at the stage of primary circular reactions which affect infant's body itself, we suppose. This is the reason that the Ss seemed to respond in voice to voice less frequently after three months than at two months. We suppose that the schema of response in voice to voice develops by practice at one and two months a little, and after three months the schema of phonation and articulation develops rather intensively as one of the secondary circular reactions in the domain of non-communication utterances and the schema of response in voice to voice does not develop.

Especially at the latter part of the third stage, i.e. at about four and five months, the Ss seemed to utter non-communication voices more frequently when they were alone, especially when in their own crib, than when with someone. We think that it occurred partly because their secondary circular reactions developed much at this time and partly because they were fond of playing with someone or looking at new objects when they were with someone, based on the development of their cognition and motor skill.

As shown in Table 4 and Fig. 3, T.Y. uttered more variationful voices when he was alone, and uttered more simple voices in expressing their emotions and in responding to voice. We think that the Ss' articulation mechanism develops at first in the domain of the non-communication utterances and that then the Ss use it in expression and in communication. At this stage, expression does not mean communication, and expression in voice is one part of undifferentiated bodily expression as a whole. We think the schema of using voices in expression began to differentiate from this stage.

4th Stage: Repetitive babbling; about six to eight months. The Ss' articulation mechanism developed further. They repeated some similar articulations rhythmically (3).

We think the basic tendency of the speech development at the third stage, especially from three months, develops further through this stage. Sometimes the Ss used voices for asking, e.g. asking foods when they were eating, and for evocation. We do not think their asking in voice was differentiated from their bodily emotional expression as a whole. As a matter of fact it was very difficult to distinguish these voices from crying. Some of the Ss uttered voices when they found their father or mother enter their room. We think the utterance is rather undifferentiated one consisting of some kind of expression of happiness, finding their parents, and some kind of evocation.

5th Stage: The decrease in the repetitive babbling and the development of prelinguistic communication in voice; about nine months to one year. The Ss tended to divide one long repetitive babbling into several pieces. Their response in voice and evocation to others developed (3).

At first response in meaningless voice to others' voice, then imitation in voice developed through this stage. The Ss' talking to others did not develop much. We

did not find any significant differences between the number of non-communication utterances when the Ss were with someone and that when alone. In some cases the number of non-communication utterances when they were alone decreased. In many cases the number of crying decreased, too. As shown in Table 2, 4, Fig. 3, in some cases they seemed to imitate their parents' word and uttered repetitive babblings, which were modified by the word spoken by their parents. When they were playing alone sometimes they uttered repetitive babblings actively. After they tried to imitate their father's or mother's word, they played alone and uttered repetitive babblings, articulation of which was similar to that of the word.

According to Piaget, from eight or ten months to about one year is the fourth sensorimotor stage: the stage of the co-ordination of the secondary circular reactions and their application to new situations. The schemata constructed by secondary reactions during the previous stage become susceptible of co-operation among themselves, some serving as means and others setting a goal for action (4), (5).

We think that at the fifth stage the Ss co-ordinated schemata; the schema of phonation and articulation, the schema of response in voice to voice, the schema of evocation, and the schema of using voices in expression; and they applied them to communication situation. After the schema of phonation and articulation reached at its peak in the stage of the secondary circular reaction, the schema of voice response to voice, which did not develop much by that time, developed. Imitations of other person's speech can be considered as the co-ordination of the schema of response in voice to voice and the schema of phonation and articulation, at this stage. The Ss' spontaneous utterances to other person can be considered as the co-ordination of the schema of phonation and articulation, the schema of evocation and the schema of using voices in expression.

On the other hand, the organization of the Ss' cognition of external voice stimuli referring to certain behaviors or to certain objects developed especially through this stage (3).

6th Stage: The development of phonemicization, i.e. phoneme-systematization; from about one year (3).

Some of the Ss began to use conventional words from eleven months, some from thirteen months, not only imitatively but also spontaneously. Even at about one year, their articulation was not correct.

The Ss used their voices in conversation-like situation actively, not only in response to voice but also in talk to others. As shown in Table 4, 5, and Fig. 3, 4, they talked to their family members with meaningless voices, i.e. at first with repetitive-babbling-like voices or simple ones, then with rather long complex voices in almost the same intonation as that of sentences used in a conventional conversation. It is considered that they were talking about something to their family members in their own way. Sometimes family members could understand what they were

talking with the help of their understanding of the situation, sometimes could not. At about fourteen months they used some conventional words in a conversation situation, though their articulation was not correct. They used a certain word, exactly speaking word-like voices, i.e. somewhat different articulations from time to time, not only in a correct situation but also in an incorrect situation, e.g. C.C. said "light" pointing at the light and also said it when he was expected to say "shoes", and they uttered the word-like voices even when they were playing alone, too.

They imitated their parents' voices not only when they were asked to imitate the voices by their parents but also when their parents were talking to them without asking to imitate, e.g. C.C. tried to imitate the sentence "I love you" which was talked to him by his mother. When they were playing alone with their parents nearby, they picked up some words of sentences spoken by their parents in a conversation with other adults and imitated the words. Their meaningless voices' articulation was influenced by their parents' voices, e.g. T.Y. uttered [æɪtə:] like voice when he was talked by his father "Newspaper? [ɕinbunwa]". Even after they began to speak conventional words rather constantly, their articulation was modified by their parents' voice, e.g. T.Y.'s "bow wow [wanwa]" was modified to [wɔjəwɔjə] by father's "ear [mimi]".

According to Piaget, from about one year to one year and three or four months is the fifth sensorimotor stage: the stage of the tertiary circular reaction and the discovery of new means through active experimentation. The innovation has an interest of its own, and this certainly implies stock of schemata for comparisons to be possible and for the new fact to be sufficiently like the known one to be interesting and sufficiently different to avoid satiation. Circular reaction will consist of a reproduction of the new phenomenon, but with variations and active experimentation that are intended precisely to extract from it its new possibilities. This reproductive assimilation with differentiated and intentional accommodation may be called the tertiary circular reaction. In this way, a series of responses grows up which everybody admits as having the character of intelligence (4), (5).

We think the Ss' speech behavior at the sixth stage can be considered as one of the tertiary circular reactions. Based on the maturation of articulation organs they could get new articulation utterances by imitation. They assimilated the new articulation utterances reproductively in various ways actively, e.g. T.Y.'s [hahaha]-like voices and C.C.'s light-like voices.

The schema of using voices in expression differentiated from the bodily emotional expression further. On the other hand, the organization of the Ss' cognition of their environment developed much. It can be considered that they understood the situation and what their parents said and they expressed their needs, their ideas, etc., uttering meaningless voices. Based on the development of their cognition of external voice stimuli, they began to use conventional words.

We will describe further development of their speech communication on our next paper.

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Table 2. The Developmental Process of Communication Utterances of T.Y., a Male Japanese.
The Figure shows the average number of utterances for ten minutes. Refer to Fig. 1.
M : mother F : father

Stage CA	Recording Situation	Communication Utterances									Non- communication Utterances	Crying
		Voice Responses to Voice				Spontaneous Utterances				Total		
		Using* ¹ Words	Imitation	Others	Total	Naming	Evocation	Others	Total			
2nd 0 ; 1	In the crib, with M, F.			2	2				0	2	84 ↑	0
	In F's arms.			1	1				0	1	15	0
3rd 0 ; 2	In the crib, with M, F.			5	5			2* ²	2	7	75 ↑	4
	In F's arms.			4	4				0	4	23	0
0 ; 3	In the living room, with M, F. After drinking juice, taking a bath.			2	2				0	2	71 ↑	0
	In the living room, with M, F. Before drinking, bathing.				0				0	0	42	56* ³
0 ; 4	In the living room, with M, F.			3	3				0	3	36 ↓	90* ⁴
	In the living room, alone.									—	152	0
0 ; 5	In the living room, with M, F.			3	3				0	3	40 ↓	0
	In the living room, alone.									—	86	0
4th 0 ; 6	In the living room, with M, F.				0				0	0	18 ↓	7
	In the living room, alone.									—	73	0
0 ; 7	In the living room, with M, while eating.				0			39* ⁵	39	39	35 ↓	30* ⁵
	In the living room, alone, after eating.									—	73	5
0 ; 8	In the living room, with M, F.			2	2		1	1	2	4	28 ↓	0
	In the living room, alone.									—	55	13
5th 0 ; 9	In the living room, with M, F.			10	10				0	10	44	0
	In the living room, alone.									—	58	7
0 ; 10	In the living room, with M, F.		7	5	12				0	12	74* ⁶	0
6th 0 ; 11	In the living room, with M, F.		6	6	12	1* ⁷	2	11* ⁸	14	26	57* ⁹	1
	In the living room, with M, F.		7	5	12	1* ¹⁰	7		8	20	31	2
1 ; 1	In the living room, with M, F.		3	6	9		3	9* ¹¹	12	21	32	2
1 ; 2	In the living room, with M, F.	3* ¹²	6	5	14		3		3	17	64	0

*1 Excluding imitation.

*2 S seemed to ask F to continue making S's hands wave.

*3 S was thirsty and sleepy.

*4 S's diaper was wet.

*5 Asking food.

*6 Including eleven bowwow-[wanwan]-like ones.

*7 S found a dog's picture in his book and uttered [ma:] instead of bowwow [wanwan].

*8 Talking to someone uttering hahaha-like ones and other meaningless voices.

*9 Including five hahaha-like ones.

*10 When S's diaper got wet S uttered [e].

*11 Talking to M, F uttering meaningless voices.

*12 Bowwow [wanwan] and streetcar [tɔɪntɔɪn].

a←b : a is larger significantly than b at 1% level, by χ^2 test.

Table 3. The Deelopmental Prcss of Communication Utterances of C.C., a Male American.
The Figure shows the average number of utterances for ten minutes. Refer to Fig. 2.
M : mother F : father

Stage CA	Recording Situation	Communication Utterances									Non- communication Utterances	Crying
		Voice Responses to Voice				Spontaneous Utterances				Total		
		Using* ¹ Words	Imitation	Others	Total	Naming	Evocation	Others	Total			
4th 0 ; 6	In the living room, with M, while eating.	2		2	1		82* ²	83	85	0 ↓ 102	41* ²	
	In the crib, alone, after eating.								—		5	
0 ; 7	In the living room, with M, F.			0				0	0	18 ↓ 102	43	
	Alone in the crib.								—		11	
0 ; 8	In the living room, with M, F.	1		1				0	1	10 ↓ 68	0	
	Alone in the crib.								—		2	
5th 0 ; 9	In the living room, with M, F.	15		15	1			1	16	21	0	
	Alone in the crib.								—	20	10	
0 ; 10	In the living room, with M, F.	17* ³		2	19				0	19	18	0
	Alone in the crib.									—	30	3
6th 0 ; 11	In the living room, with M, F.	5		5	10	1* ⁴			1	11	25	0
	Alone in the crib.									—	32	0
1 ; 0	In the living room, with M, F.	2		10	12	2* ⁵		2	14	35* ⁶	0	
1 ; 1	In the living room, with M, F.	15* ⁷	5	2	22			0	22	37* ⁸	3	
1 ; 2	In the living room, with M, F.	5* ⁹	7	3	15	2* ¹⁰	1* ¹¹	3	18	31* ¹²	0	

*1 Excluding imitation.

*2 Asking food.

*3 Mostly imitations of M's lip vibration by finger.

*4 S looked at M go out of the house by her car and shouted [ma:çæ] instead of [mama:].

*5 Talking to M, uttering meaningless voices.

*6 Including six OK-like ones.

*7 Humhum-like ones.

*8 Including thirteen humhum-like ones.

*9 Light.

*10 S pointed at the light and uttered two times.

*11 Hi.

*12 Including eight light-like ones.

Table 4. The Speech Development of T.Y., a male Japanese.

M : mother F : father S : subject N : Nakazima

Stage CA	Non-crying Utterance	Voice*1	Response to External Voice Stimuli	Other Behavior
2nd 0 ; 1	When S was talked to, his utterance was activated.	[ɣə:] [ə: ə: ə:]	S was stimulated to utter by F's [uriku:].*2	
3rd 0 ; 2	S's utterance, when he was alone, became active. Calm voice, alone in bed. [ɣə:ə] S seemed to ask F to continue making S's hands wave. [ʔə ʔə] [ə:ə]		Response to F's [urɯə].*2	
0 ; 3	Calm voice, alone in bed. Expression of pleasant feeling, e.g. when playing with M. [æ] Expression of unpleasant feeling, e.g. with a wet diaper. [æ:] These utterances turned into crying easily.	[æə:æ]		
0 ; 4	Utterance, alone in bed, in high pitch, [æ:] in low pitch. [ə:]			Utterances, while alone, increased. S did not utter much, while with someone.
0 ; 5		[æ] [ə:]	Response in high pitch to F's "hey" [jai]. Response in low pitch to F's [urika]*2 in low pitch.	
4th 0 ; 6	Calm voice, playing alone. [m:m:] [mae:jabdʒ] While eating, S asked more food to M. [mjəmmjəm] [m:] These utterances turned into crying easily.			While eating, S was not only uttering but also tapping the table with his hand, moving his body, etc..
0 ; 7~ 0 ; 8	When F entered S's room S looked at him and shouted, in high pitch. [a:] When S wanted to touch TV's switch and was stopped by M, S shouted, then cried. [æ:]			

*1 These voices are not the same as those described by phonetic symbols but only roughly similar to them. Refer to their sonagrams, in Fig. 3.

*2 [ur:], [uriku:] are imitation of S's utterance at this stage.

		[u:]	When S was playing alone pleasantly with F nearby, S responded to F's "Hey" [kofja].	
5th 0 ; 9		[ə]	Response to M, calling his name. Conversation-like responses to M and F; M : "You say bowwow [wanwan]." S tried to take the microphone into his mouth. F : "It is dirty".	
	When S was playing alone with F nearby, S uttered.	[mə]		
		[bu]		
		[ətətətətətətə]		
0 ; 10			Imitation-like responses; to F's "No" [mem memmemme].	S waved his hand responding to F's or M's "Byebye".
		[de]		
		[æ]		
		[æ æ]		
		[burbabababa]		
		[bawawa]		
		[wa]		
		[βa]		
	When S was playing alone with F or M nearby, S uttered.	[bababa]		
		[gauruwa]		
		[ur:wa]		
			S stopped when he heard M's "No!"	
6th 0 ; 11		[ahaha]* ³	Response to M's "Say hahahaha* ⁴ ".	
	After a while, S took a piece of toy block and uttered,	[hahaha]* ³		
	S looked at M and uttered,	[hahaha]* ³		
	S looked at aunt and uttered.	[aha]* ³		
	M showed a book to S and opened. S uttered.	[hahha]* ³		
	S seemed to ask her to open the next page uttering babbling-like meaningless voices.	[əbəɪjaɪdzeɪ]		
	After M opened the next page S uttered.	[haha]* ³		
	S found a dog's picture in the book and uttered.	[ma:]		
		[wa]		
			Response to F's "Say bowwow" [wanwan-wa].	F asked: "Which one is a bowwow?" S pointed at a dog's picture in the book.

*³ Each in monotone.*⁴ hahahaha, in monotone, is one kind of laughing sounds.

1 ; 0	A couple of times S looked at N and uttered papa-like voices.	[bapa] [apa]	
	When S's diaper got wet S uttered. Every time S was on his stool for bladder training M said [ɕ].	[ɕ:] [ɕ:]	Response to M's "Say [ɕi]".
1 ; 1	After that, S uttered a couple of times, while playing.	[ɕ:]	
	S looked at M and uttered, then to F, and so on. These were meaningless voices. S seemed to be talking to M and F alternately.	[kətɕə ko] [ɕ:kə:tɕə koe] [dɔŋkietɕə h koje] [ɔyɔ:idetɕa] [ovejaɕa:]	First imitation of F's [kofekofeka]* ⁵ , second imitation, third one.
1 ; 2	S looked at N and uttered.	[papa]	
	S went to F and uttered.	[papa]	M told to N : "He utters 'papa' all day long." S picked up this and uttered.
		[pa:] [ɕɪtə:]	Response to F's "Newspaper [ɕinbunwa]?"
	After S and M were at M's parents' home for a couple of weeks, S uttered 'papa' only when S called F.		F showed a streetcar picture to S and asked : "What is this ?"
		[tɕɪ]	"What is this ?"
		[teati:N tɕitɕiN]	"[tɕiNtɕiN]* ⁶ , that's right."
		[tɕɪtɕɪ]	F showed a dog picture to S and asked : "What is this ?"
		[u:ɕauɕa]	
		[ɕaɕwa]	"What is this ?"

*⁵ [kofe] means "this".*⁶ [tɕiNtɕiN] means "streetcar" in Japanese baby-talk.

		[ʊjəʊjə]	"Which one is my ear [mimi]?" S pointed at F's ear and uttered.
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Table 5. The Speech Development of C.C., a male American.

M : mother F : father S : subject N : Nakazima

Stage CA	Non-crying Utterance	Voice*	Response to External Voice Stimuli	Other Behavior
4th 0; 6	Calm voice, playing alone in the crib, rhythmical change in articulation, rhythmical change in stress, variation in pitch. While eating, S seemed to ask more food to M. These utterances turned into crying easily.	[m:mjəm m:mjəm] [æ:æ:ə:ɛ:ɪ] [m:m:m:] [æ:æ:æ:æ:] [m:mjəmm:m:] [m:æ:æ:æ:æm] [m:m:m:] [ə] [m:m:m:]	 Response to M's "here", giving a toy to S. Response to M's "Don't you want that?", rhythmical change in stress.	 While eating, S uttered these voices moving his body rhythmically.
0; 7~ 0; 8	When M entered his room S looked at her and shouted, in high pitch. Front-vowel-like voices, back-vowel-like voice, consonant-like voices by lips, by tip of tongue, by back of tongue. When S was playing with M, S uttered. S tried to crawl, but he could not, then shouted and cried.	[æ] [aɪaɪe] [eɪeɪ] [tʊɪ] [æm burb...] [avemib...] [tʊɪ] [əʔəʔəʔ] [ɜ:] [hŋge] [æ:]	 After a while S responded to M's "Hi".	 S's first tooth cut.
5th 0; 9		[ə:]	Response to M's "Hello". Conversation-like responses to M and F, e.g.; S was crawling. M: "Would you go?"	When M told "wait a minute" to S and went out of the room to take his diaper, S did not cry and was waiting. S seemed to understand the situation.

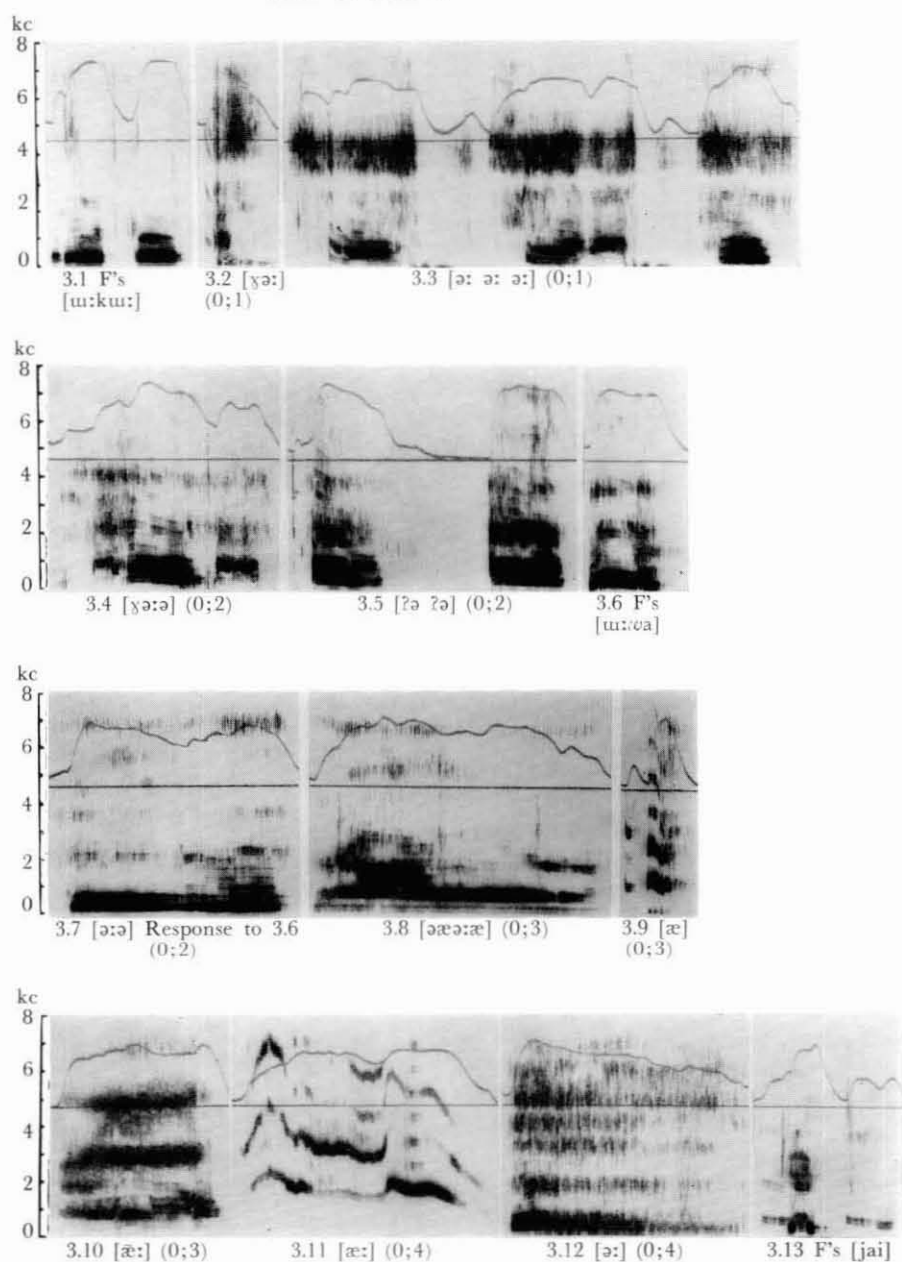
* Refer to their sonagrams, Fig. 4.

0 ; 10	<p>S looked at N and uttered.</p> <p>When S was playing alone with a noisy toy, S uttered.</p>	<p>[ŋgəwe]</p> <p>[u:bu: gəwe] (At first falling, then rising intonation.)</p> <p>[ija:ŋ]</p> <p>[ha]</p> <p>[eiei]</p> <p>[amβura] [bU:b]</p>	<p>M : "Oh, Where?"</p> <p>F : "What is this?", showing a toy tiger to S.</p> <p>When playing alone, S did not respond in voice to anybody.</p> <p>S imitated M vibrat- ing her lip by her finger. Sometimes S waved his finger without touching to his lips and uttered.</p>
<p>6th 0 ; 11</p> <p>1 ; 0</p> <p>1 ; 1</p>	<p>When S was playing alone with M nearby, S uttered.</p> <p>Looking at F enter S's room, S uttered.</p> <p>Looking at M go out of the house by her car, S shouted.</p> <p>S took his toy elephant and uttered, showing it to M. S seemed to be talking about it to M.</p> <p>S was playing alone with M nearby and uttered.</p> <p>After that, S was playing alone and uttered OK-like voices often.</p>	<p>[l]</p> <p>[ʔæ]</p> <p>[gaUgaUkatUpau waUwaUjaUtçæ]</p> <p>[hmhm]</p> <p>[ma:çæ]</p> <p>[a:UU] [aI]</p> <p>[ə:]</p> <p>[pæ ə]</p> <p>[əke:]</p> <p>[hohei]</p>	<p>Responding M's [dadadada] S con- tinued opening and closing his mouth a couple of times without utterance.</p> <p>Response to M's "Peek-a-boo".</p> <p>Response to M's "Hi".</p> <p>Responses to N's "Hi".</p> <p>Response to M's "Where is the elephant?".</p> <p>Imitation of M's "OK".</p> <p>Talking with M; M: "Where is a kitty cat?"</p>

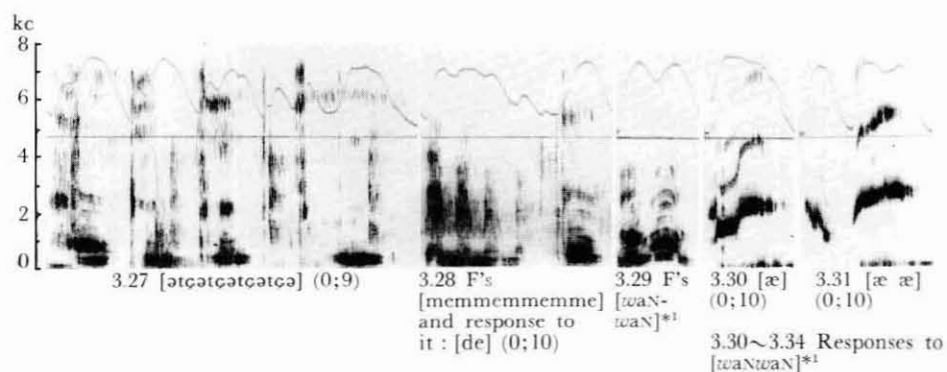
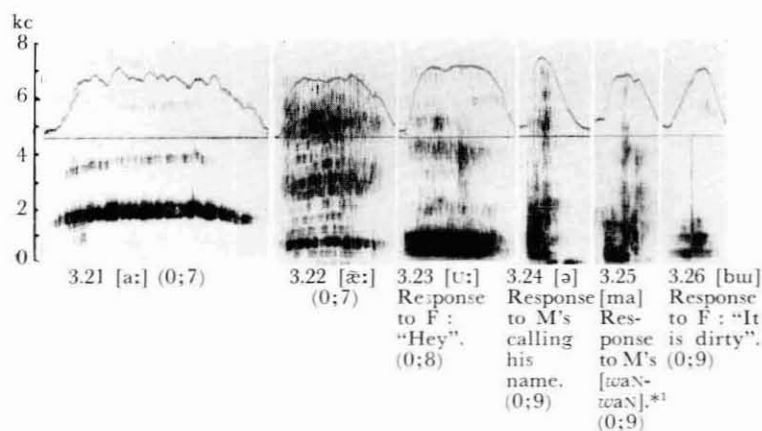
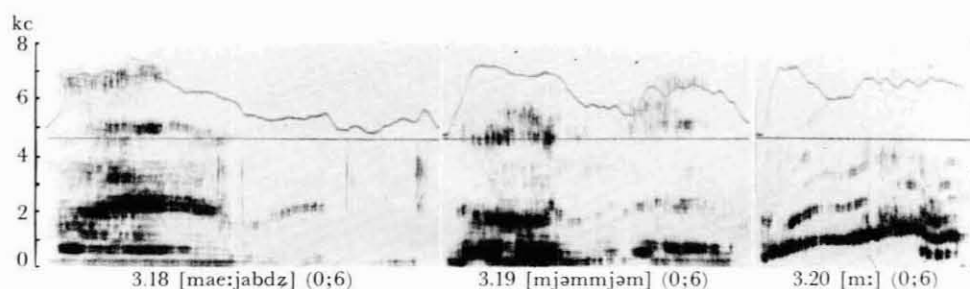
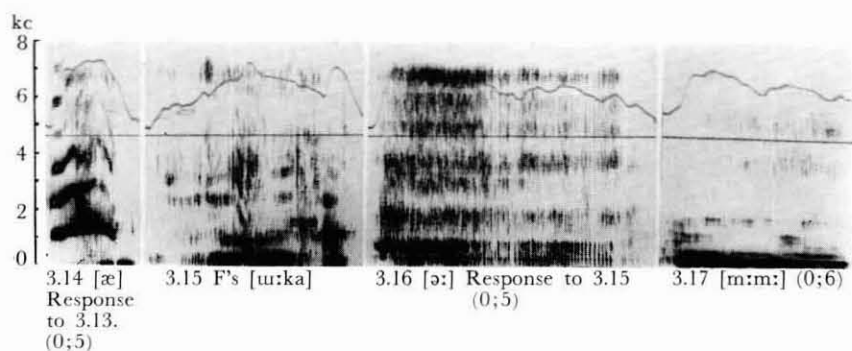
When S was playing
alone with M or F
nearby, S uttered very
often.

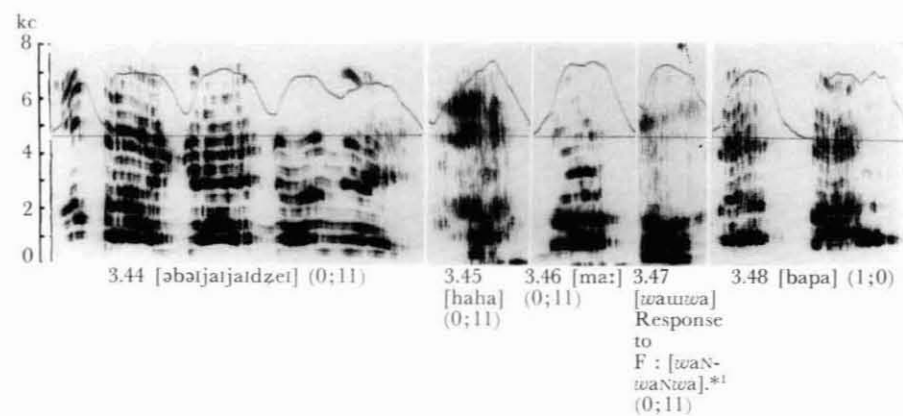
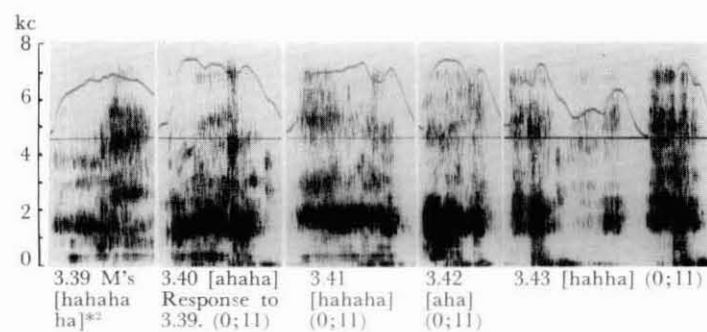
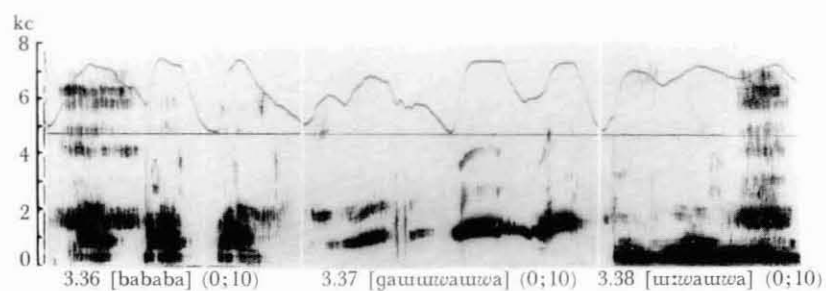
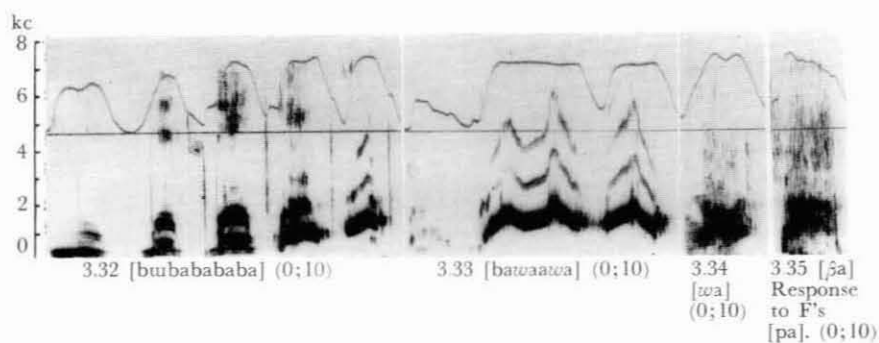
[m:mja:]	M : "Miaow."
[əmmja:]	After a while, M : "Where is a kitty cat?"
[waUɣaU]	M : Miaow."
[ɛja:æ]	
[ai lja] (both in falling intonation)	Imitation of M's "I love you". (each word in falling intonation) Talking with F; F: "Is is a microphone?"
[həhə]	
[əhə]	F : "Is it a micro- phone?"
[həhə]	F : "Christofer!"
	S was playing with a book. F : "Is that your book?"
[hmhm] (each in rising) intonation	...etc..
[həhə] or [əhə] or [hmhm] (in rising) intonation	
[ənzəzə]	Imitation of F's [za za za ʃu ʃu ʃu].
[tjU]	Imitation of F's "shoe", in rising intonation.
[ɕə] (both in rising) intonation	Once more.
[əv]	Imitation of M's "Wolf wolf".
[pli:]	Response to M's "Say please!" M : "Make the lady sing!" S wound up the screw of his doll to make it sing and uttered.
[ɕəljuaioɣal]	M : "Cay you make it sing again?" S wound up again and uttered. S seemed to be answering to M.
[eidejaŋke:]	
[ʃə]	Response to M's "Say shoes".
[ai]	Response to M's "Can you say light?"
[ai]	Again.

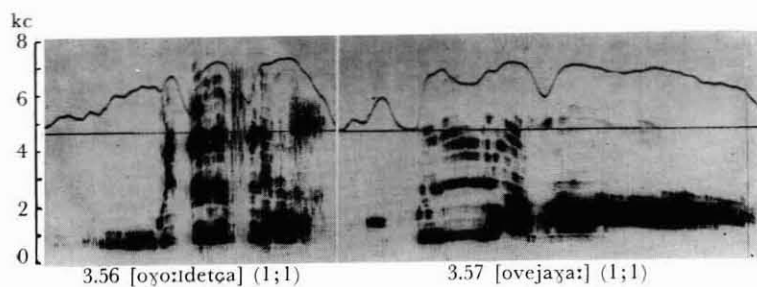
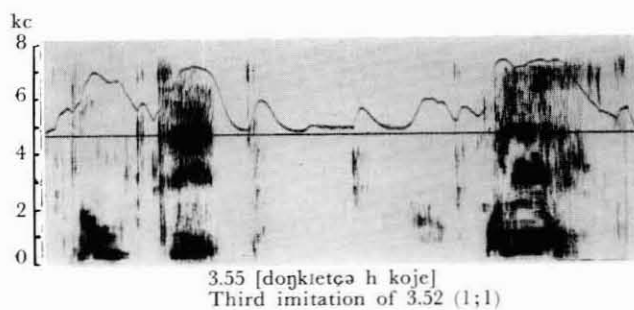
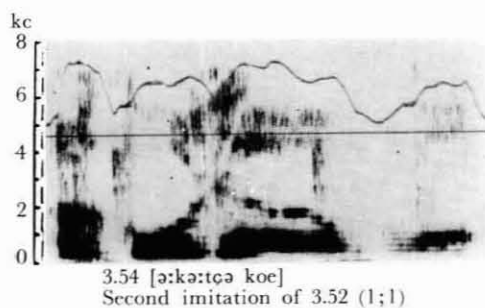
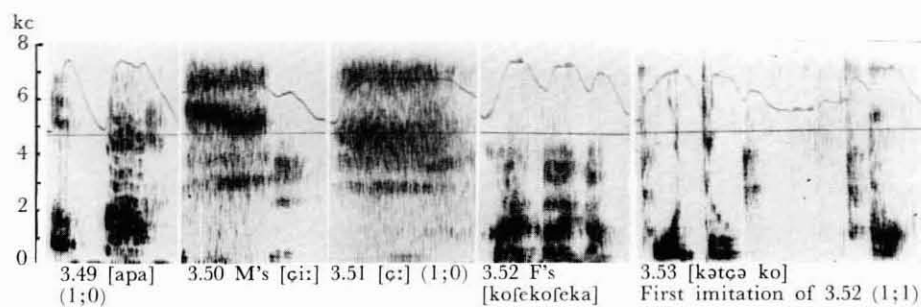
Fig. 3. Sonagrams of Voice of T.Y., male Japanese.
Refer to Table 4.

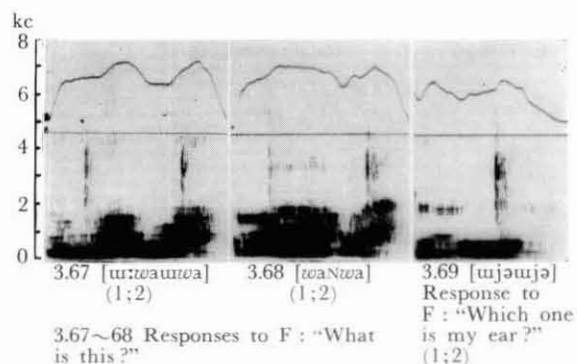
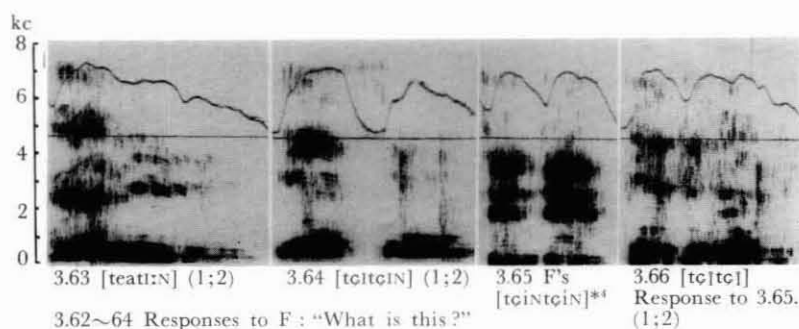
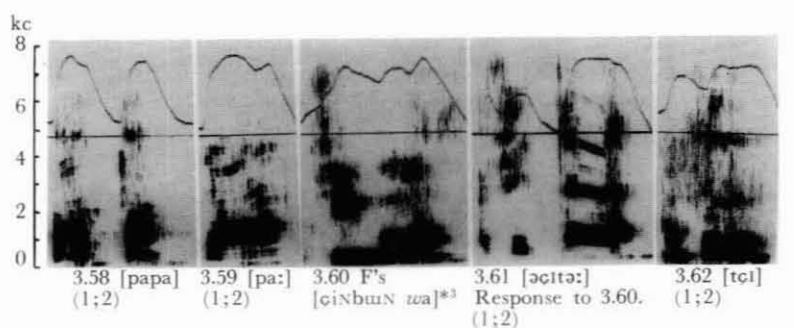


These voices, shown on sonagrams, are not the same as those described by the phonetic symbols, only roughly similar to them, e.g. [ə] means [ə]-like voice etc..









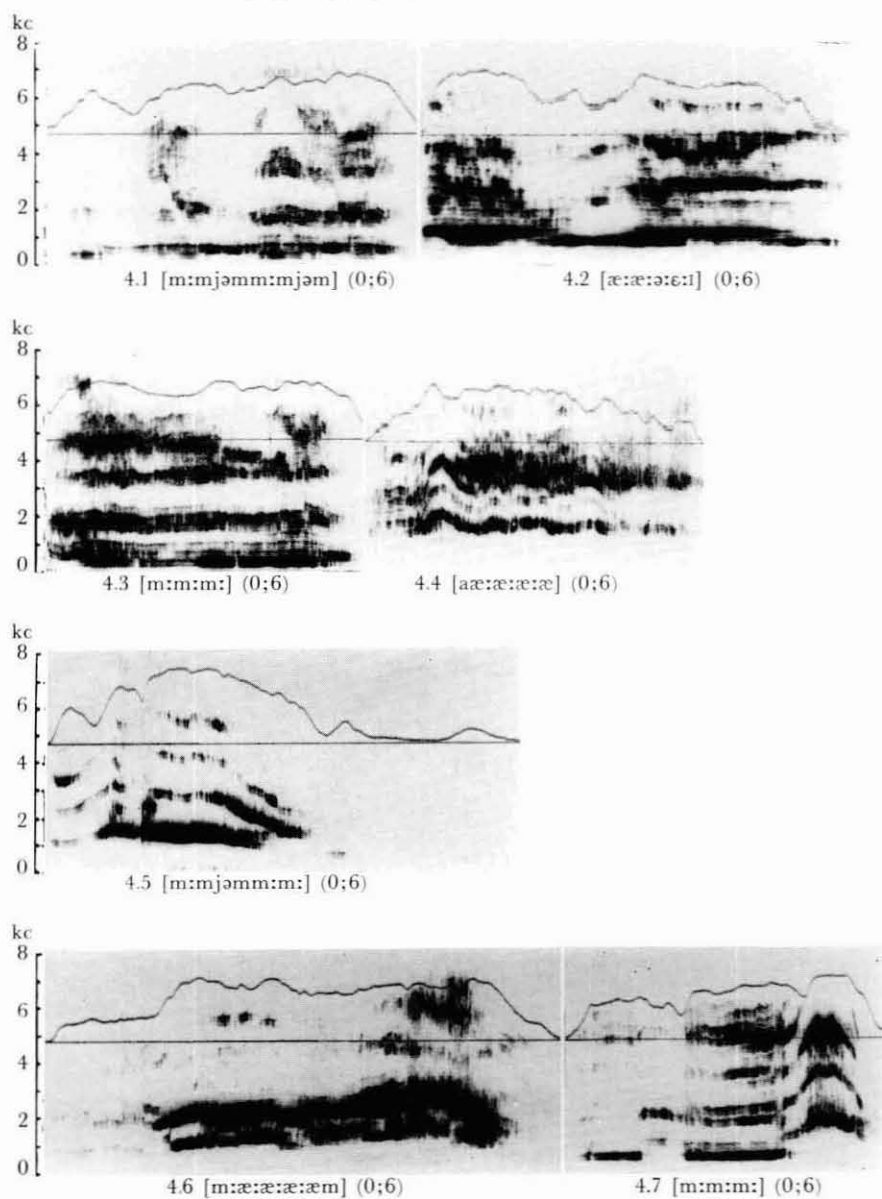
*1 [wəwəwə] or [wəwə] means "bow wow".

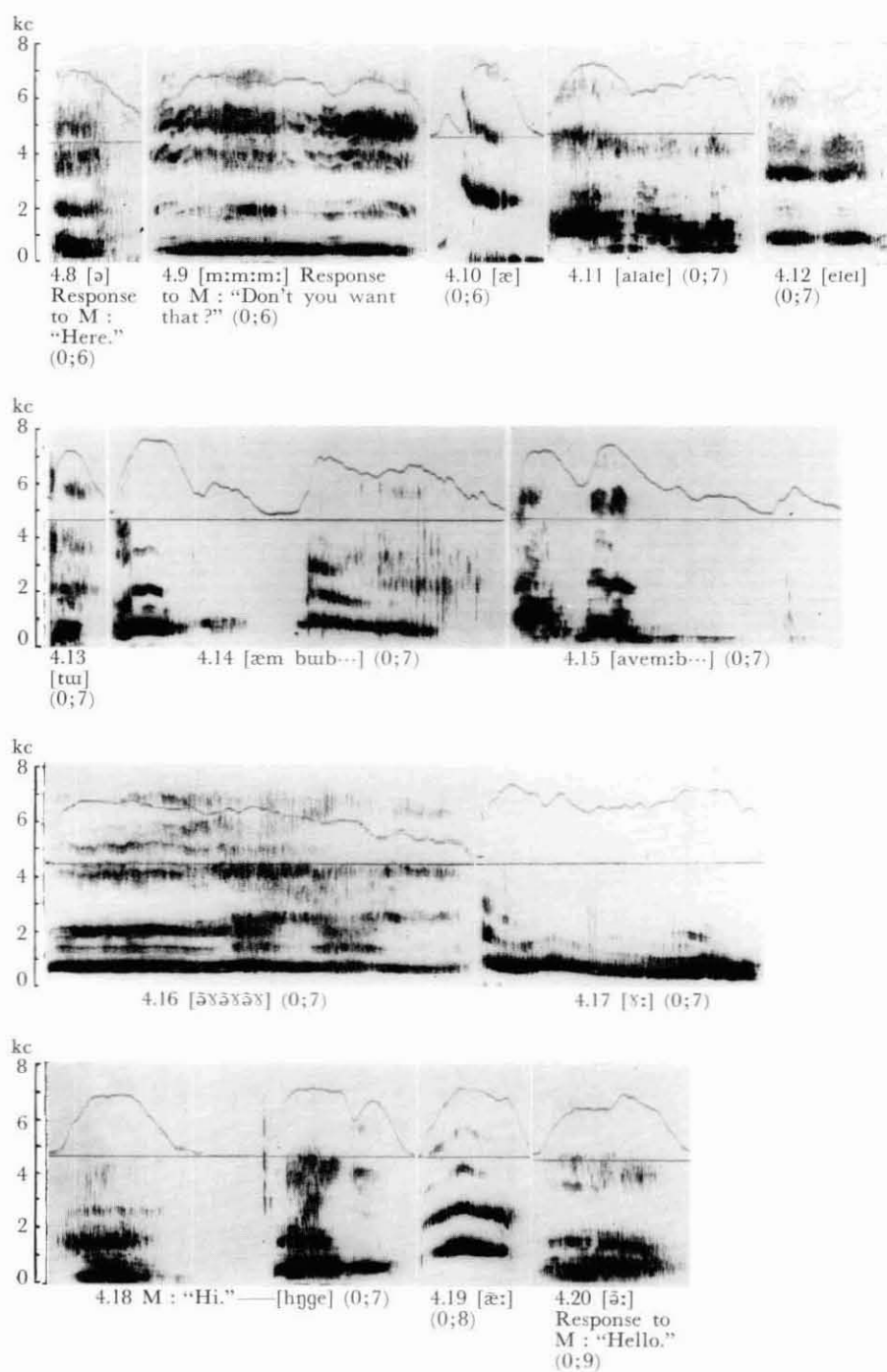
*2 [hahahaha] is one kind of laughing sounds.

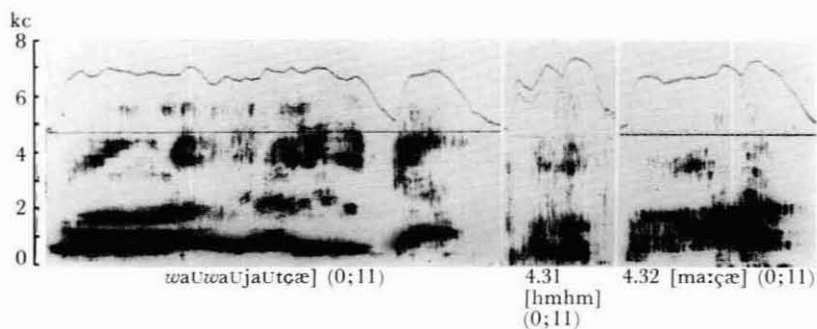
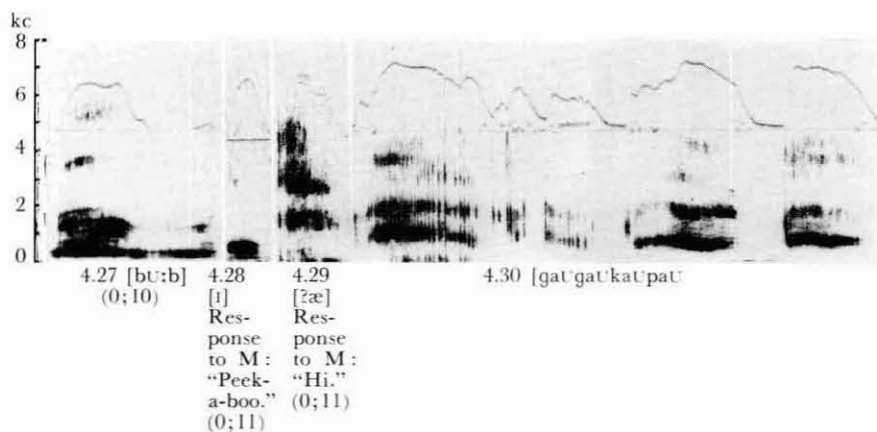
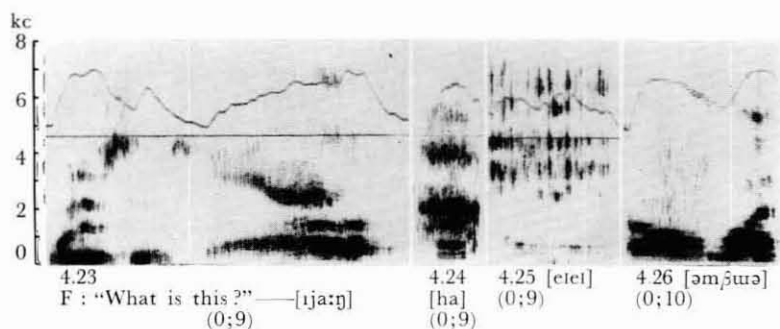
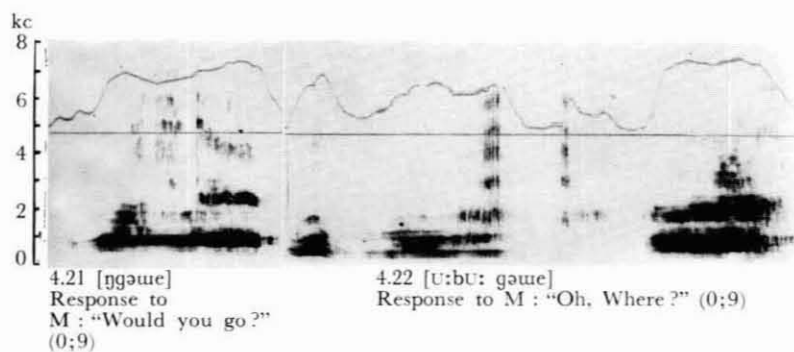
*3 [ɕinbʊN] means "newspaper".

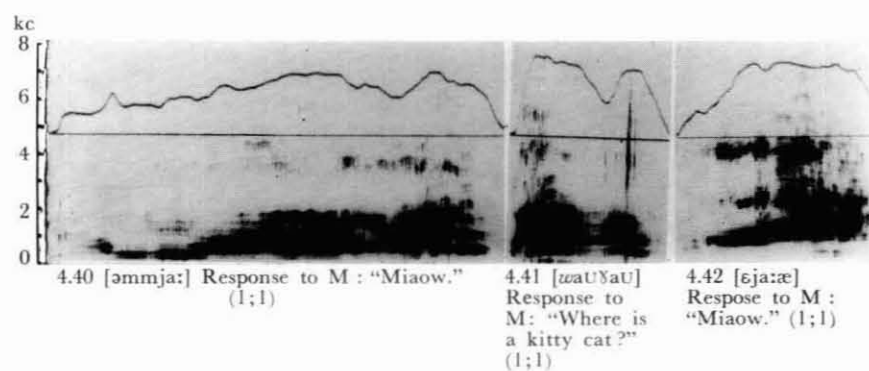
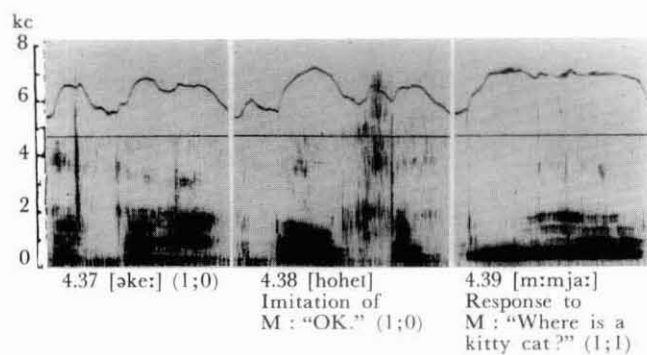
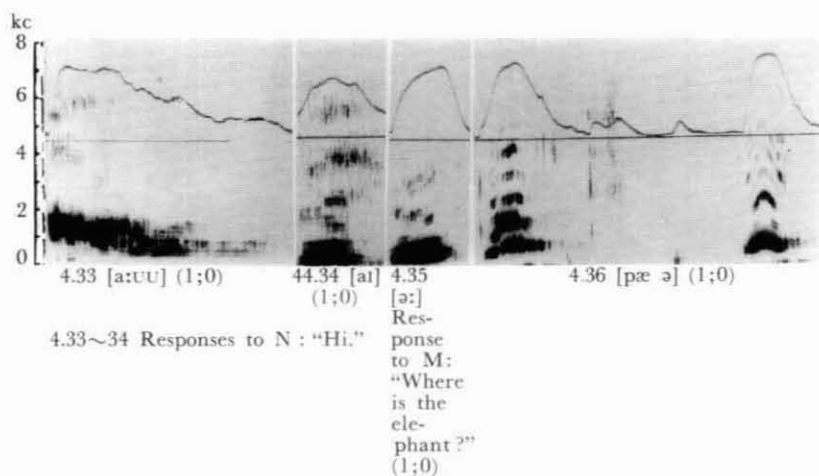
*4 [tɕɪntɕɪN] means "streetcar".

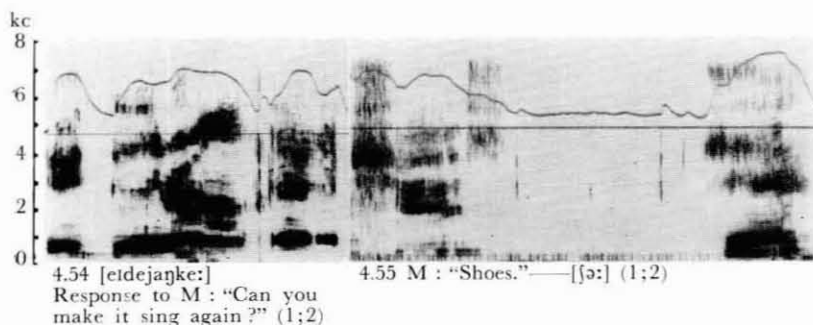
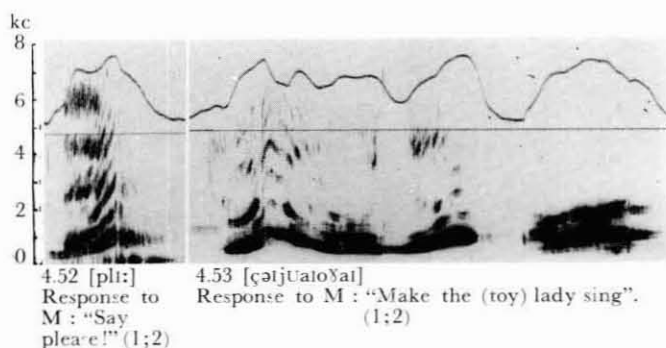
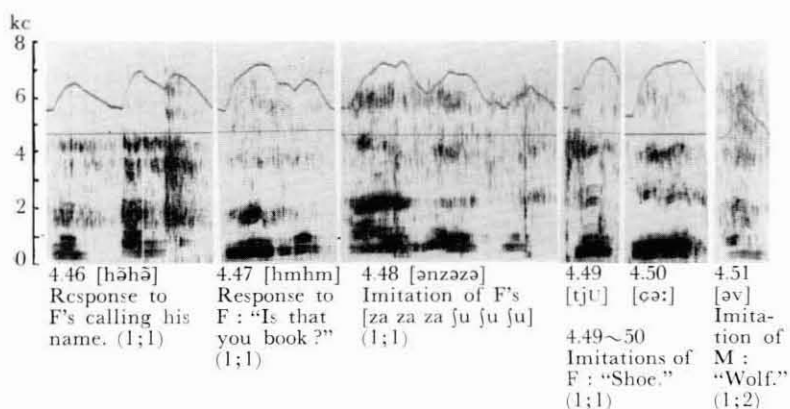
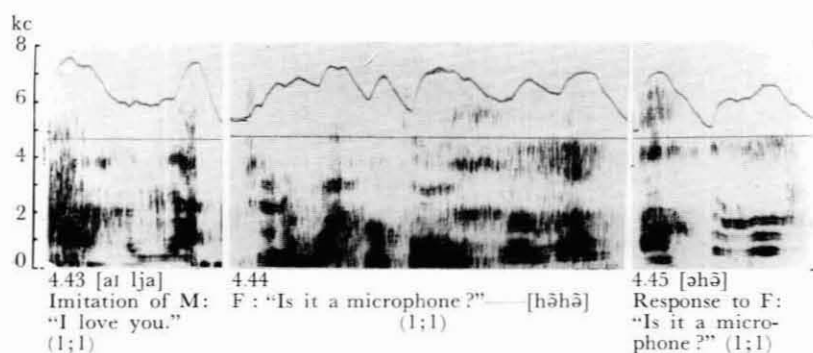
Fig. 4. Sonagrams of Voice of C.C., male American.
Refer to Table 5.

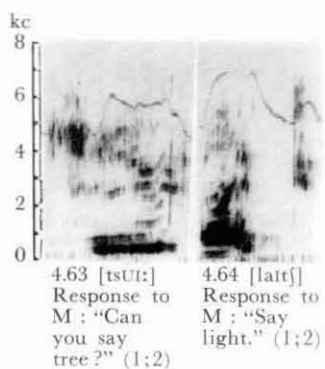
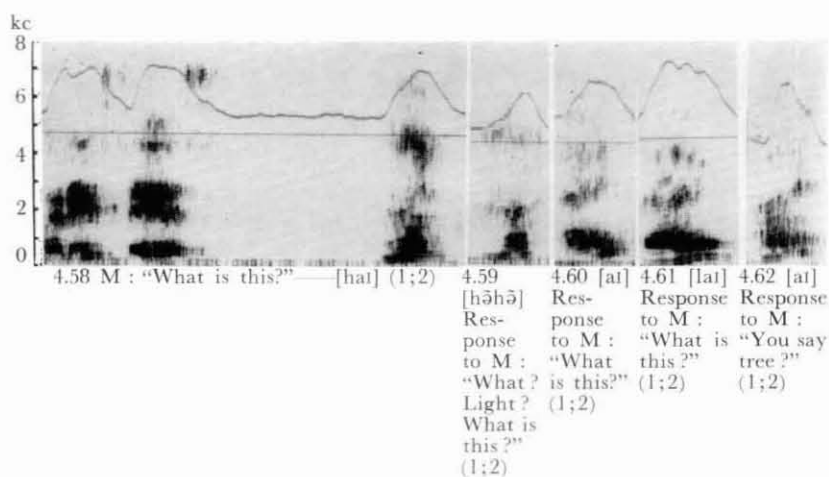
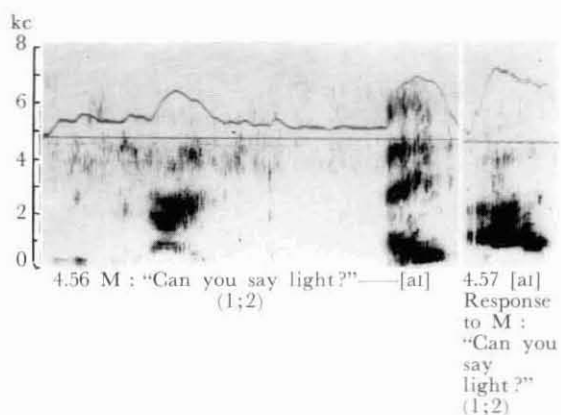












<p>S pointed at the light, turned on by M, and uttered.</p> <p>When S was playing alone with M nearby, S uttered light-like voices often.</p>		After two weeks, M turned on a light and asked: "What is this?"
	[hai]	"What? Light? What is this?"
	[hōhō]	"What's this up here?" M let S stand and asked: "What is this?"
	[ai]	"Light..." "What is this?"
	[lai]	"Light..." "You say tree?"
	[ai]	"Light? You can say light. Can you say tree?"
	[tsuɪ:]	"Say light."
	[laɪt]	After a while, M: "Button".
	[aɪt]	"No, button." M pointed at her shoes and asked: "What is this?"
	[aɪt]	"No, shoes". M pointed at the light and asked: "What is this?"
	[aɪt]	"Light, that's right."
	[aɪt]	
	[aɪt]	